

IPS Virtual Paint – Sealing

Capability

- ➔ *Realistic simulation of sealing material laydown including the complex rheology of the material*
- ➔ *Straightforward and intuitive simulation setup that require no expertise on computational tools*
- ➔ *Coupling to path planning software for optimization of complete robot cells*
- ➔ *Extremely robust, accurate and fast algorithms with immediate visualization*
- ➔ *Export sealing beads as CAD for packing and geometry assurance analysis*



Benefits

- ➔ *Power (detailed physical models and accurate results)*
- ➔ *Speed (apply one meter of sealing material per hour of simulation time, substantially shortened product preparation time)*
- ➔ *Easy to use (one day crash course, GUI tailored for the sealing process)*

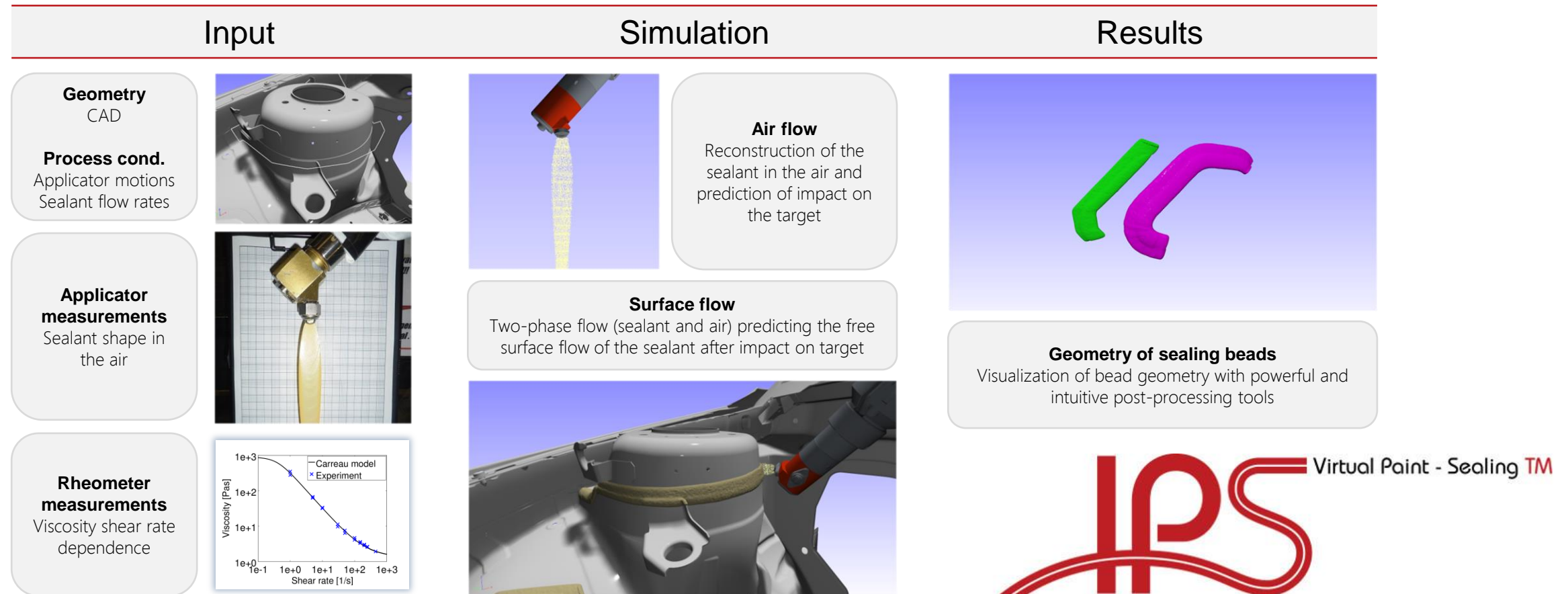
Results

- ➔ *First software on the market*
- ➔ *Successful validation campaigns*



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- Automatically generated adaptive octree grids and immersed boundary techniques
- Fast solvers using GPU acceleration running on standard computers
- Accurate simulation of the sealing process from nozzle to target and free surface flow after impact



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Simulation methods

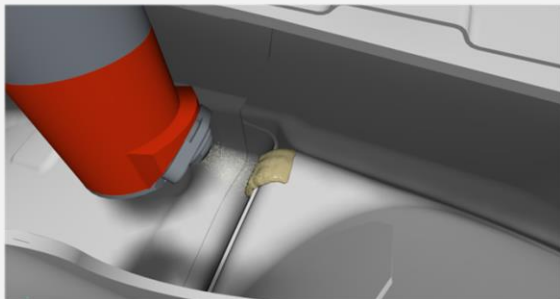
Physics-based simulation

Accuracy

Includes the most important physics of sealing laydown:

- Reconstruction of sealant flow through the air and impact on target
- Simulation of two-phase surface flow of sealant after impact

Accurate prediction of the sealing laydown for complex geometries and various process conditions



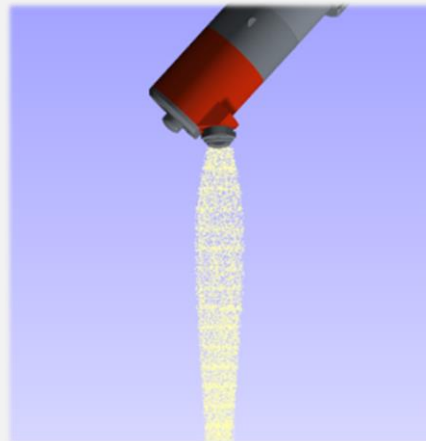
High performance

Runs on a standard computer and one meter of sealing bead can be simulated per hour

Deposit simulation

Very fast simulations

Includes the reconstruction of sealant flow through the air and impact on target but does not take surface flow into account.



Impact prediction

Reasonable prediction of sealing bead especially in areas with high applicator speed

Hybrid simulation

Smart combination

Utilization of the individual strengths of the physics-based and the deposit simulation method:

- Fast prediction of sealing bead with the deposit simulation method in areas with high applicator speed
- Accurate prediction with the physics-based simulation method for low applicator speeds

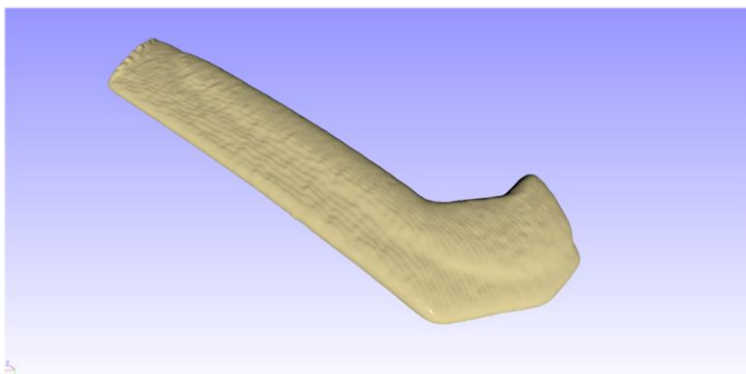
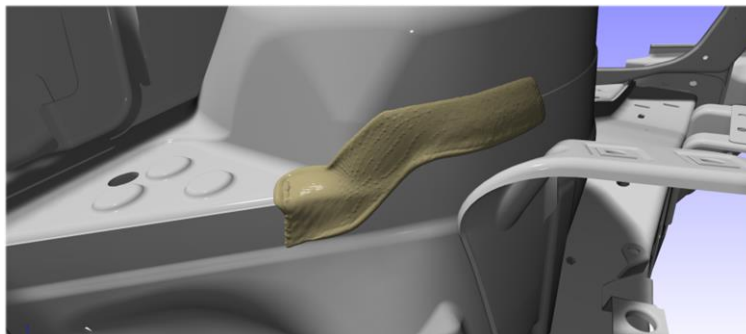
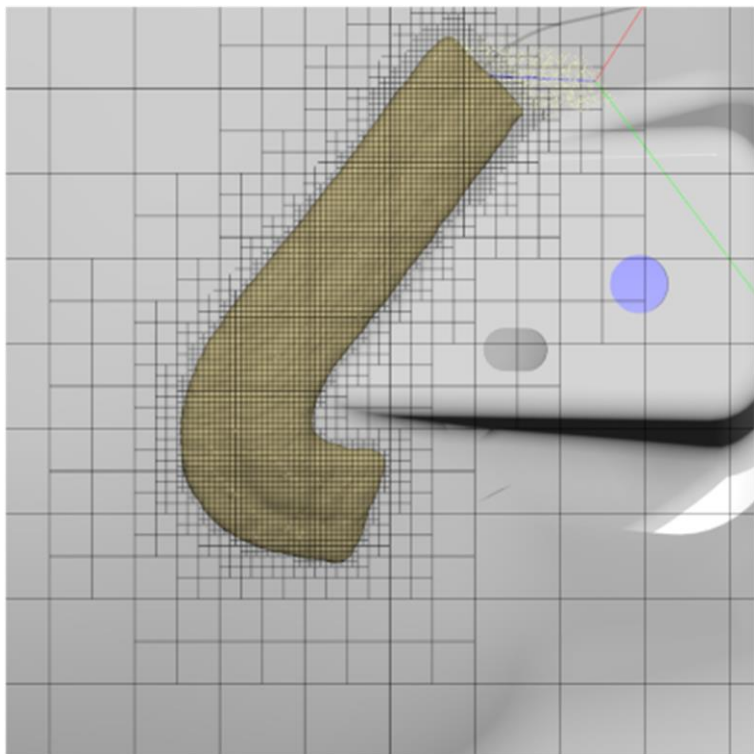
The switch based on applicator speed can be set by the user.

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Powerful and intuitive visualization and post processing tools

Computational grid

Visualization of the automatically generated adaptive grid.

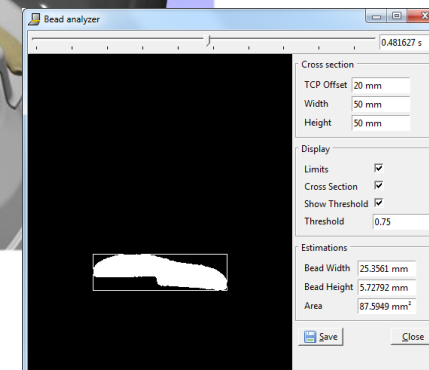
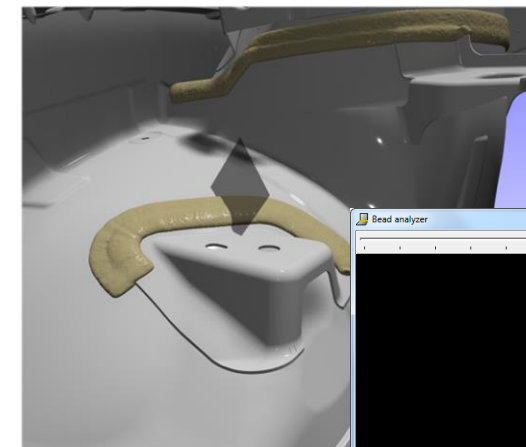


Bead geometry

The resulting sealing bead is visualized in each time step by a contour surface and may be exported in CAD format, to be used in e.g. a packing study.

Bead analyzer

View the bead in its cross section and obtain quick estimates of the bead width, thickness and cross section area.



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Technical advantages

- Extremely robust, accurate and fast method with immediate visualization
- Running on standard computer
- Fully automatic mesh generation
- Process simulation and path planning in one environment
- Easy accessible simulation input
- Coupling to path planning software for optimization of complete robot cells
- No special know-how of meshing and advanced simulation software necessary. Training in one-day

Benefits

- ⇒ Saves days of simulation time and time for correcting wrong setup
- ⇒ Saves money for HW-resources
- ⇒ Saves man days of preparation
- ⇒ No co-simulation of different complex SW-tools
- ⇒ Fast simulation setup
- ⇒ Substantially shortened product preparation and cycle time
- ⇒ Ready for productive use in short time frame

